

# A Hierarchical Environment for Virtual Supercomputing

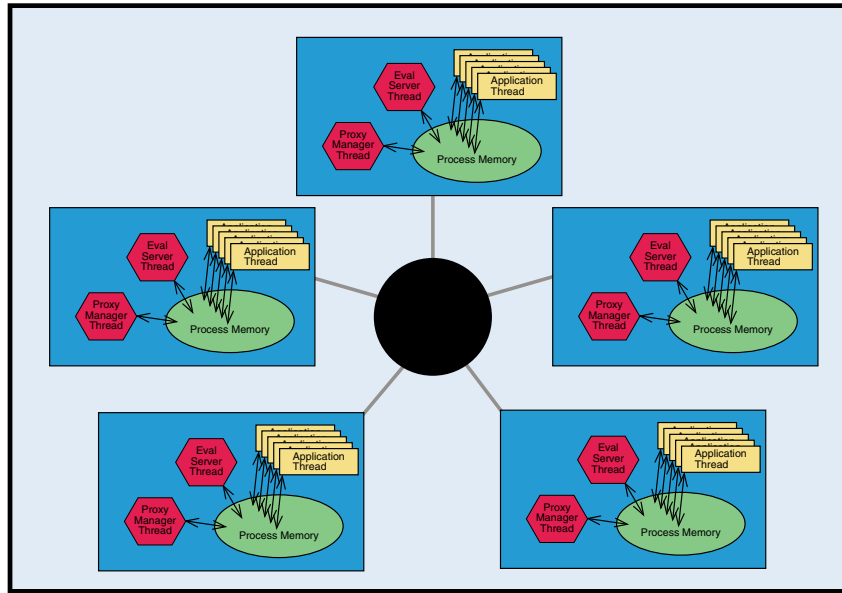
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# A Hierarchical Environment for Virtual Supercomputing



## New Ideas

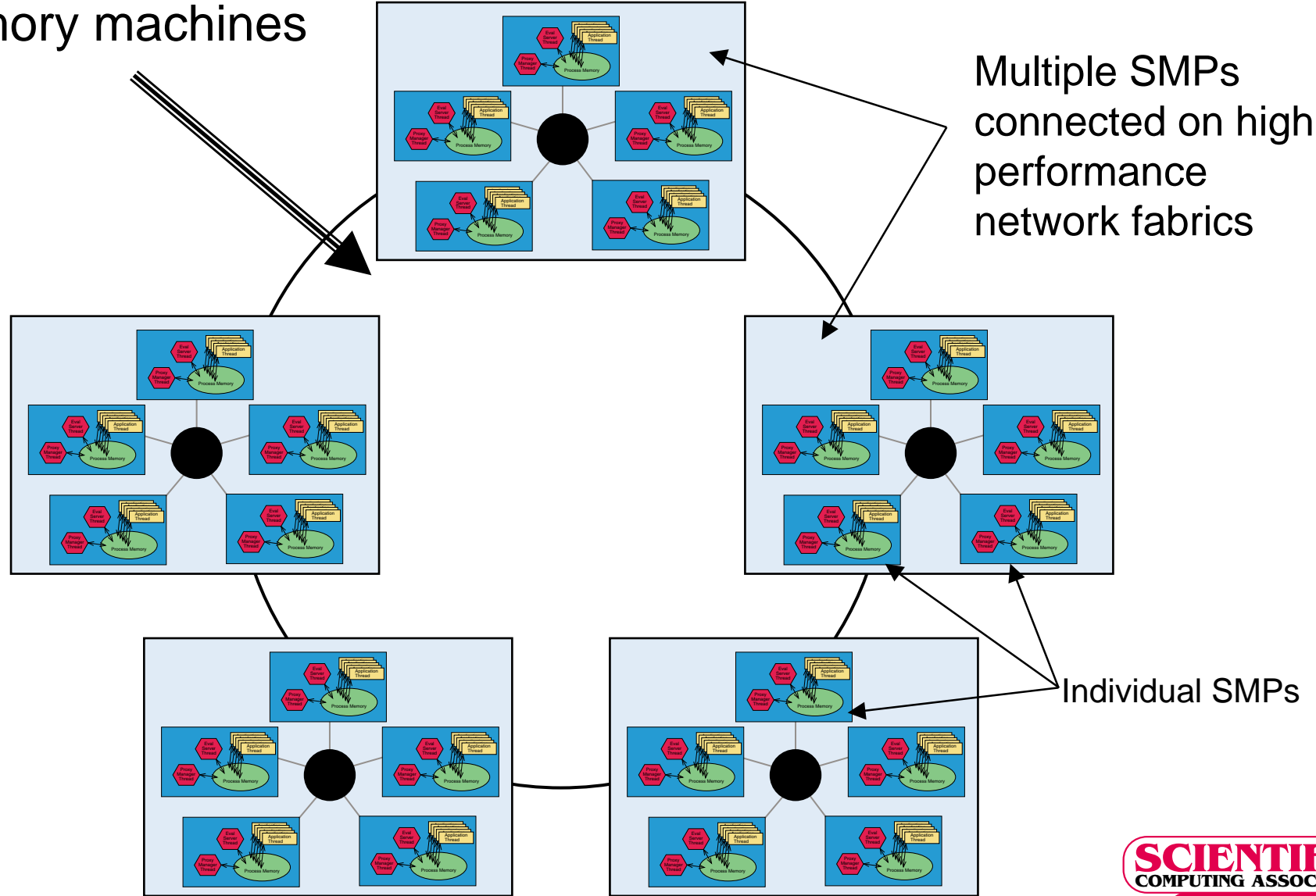
- Cost-effective HPC platforms will employ hierarchical architectures with heterogeneous components
- Virtual shared memory systems can provide the conceptual foundation for a uniform, high-performance software environment

## Impact

- Portable, high-performance software for parallel machines
- Reduction in cost of software development and maintenance
- Increased software lifetimes

# Long-Range Hierarchical Target Architecture

Cluster of hierarchical memory machines



# Objectives

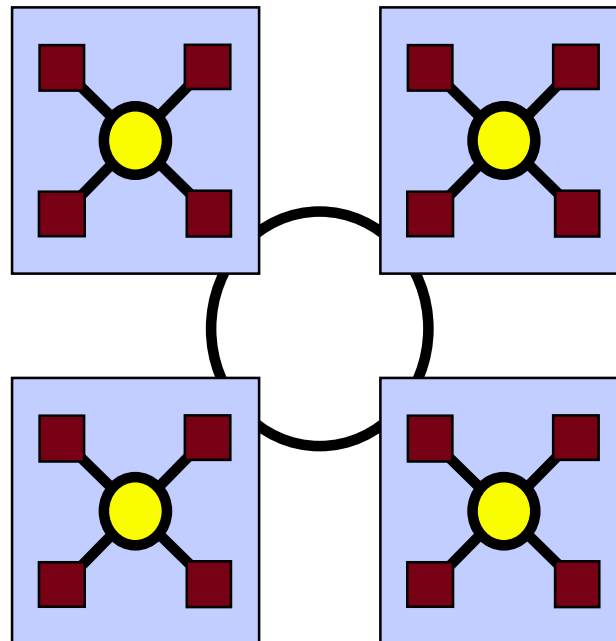
- **Investigate API design & implementation issues for parallel/distributed systems with hierarchical memory**
- **Provide code portability among parallel architectures including SMPs, distributed memory machines, & clusters**
- **Achieve high performance through**
  - Language-level processing and optimization
  - Exploitation of native compilers and libraries
  - Intelligent dynamic process/data mapping
- **Achieve ease of use by providing a uniform logical software architecture across the entire hierarchy**

# Initial Target Hardware Architecture

**Nodes: Shared Memory Multiprocessors (SMPs)  
(either PCs or workstations)**

**Interconnect: Fast Ethernet or a switch fabric  
(e.g., Myrinet, Giganet, Quadrics)**

**Operating Systems: Windows NT, Linux, Vendor UNIX**



# Possible Approaches for Linda System Software

## ■ Network Linda

- Treat each node of each SMP as a separate, full-fledged “machine” on the network

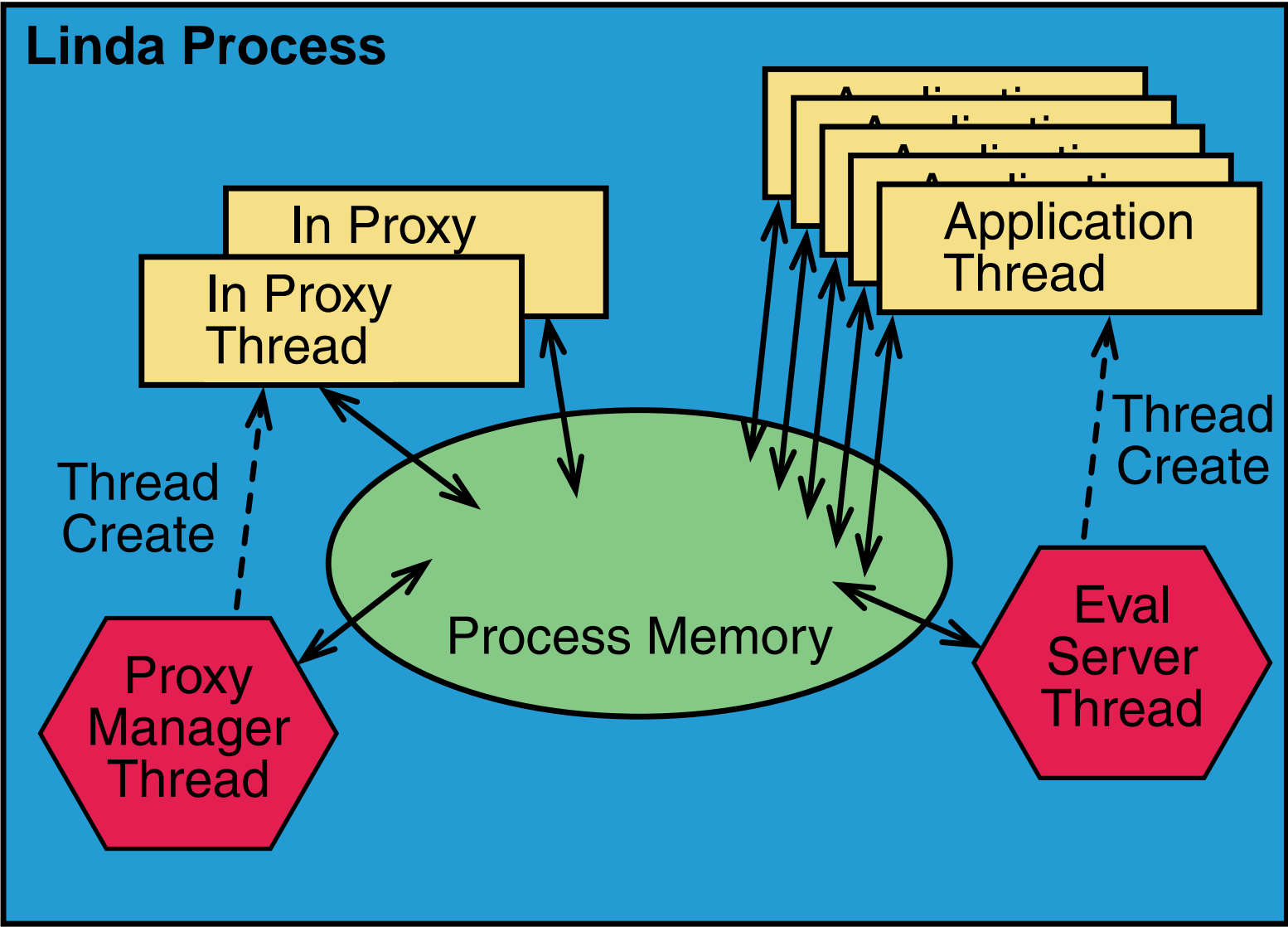
## ■ Simple Hybrid System

- Paradise server for VSM
- Native SMP or Original Linda on each SMP

## ■ Hierarchical System

- One VSM server per SMP, with all linked together to manage a single VSM
- Intelligent run-time system to exploit locality through redirection, caching and data relocation.

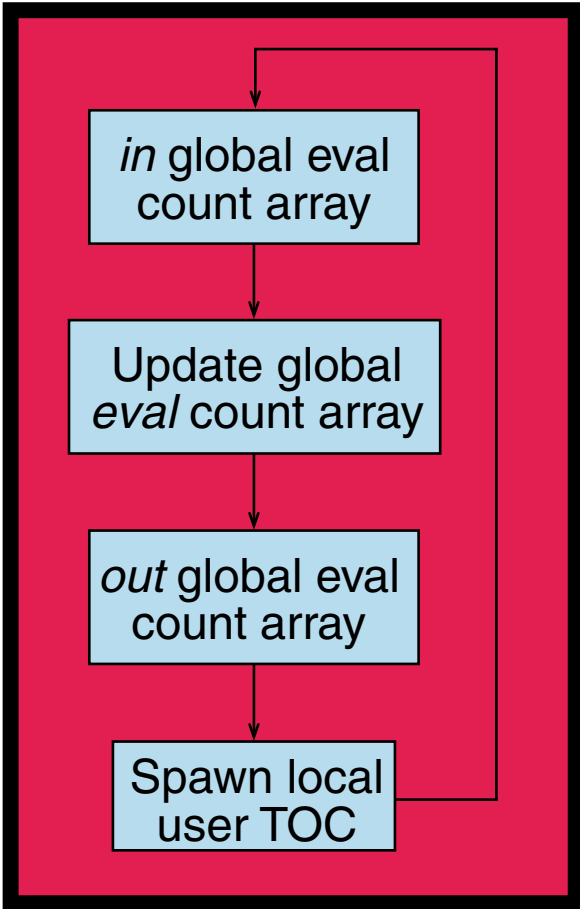
# Hierarchical Linda Software Architecture



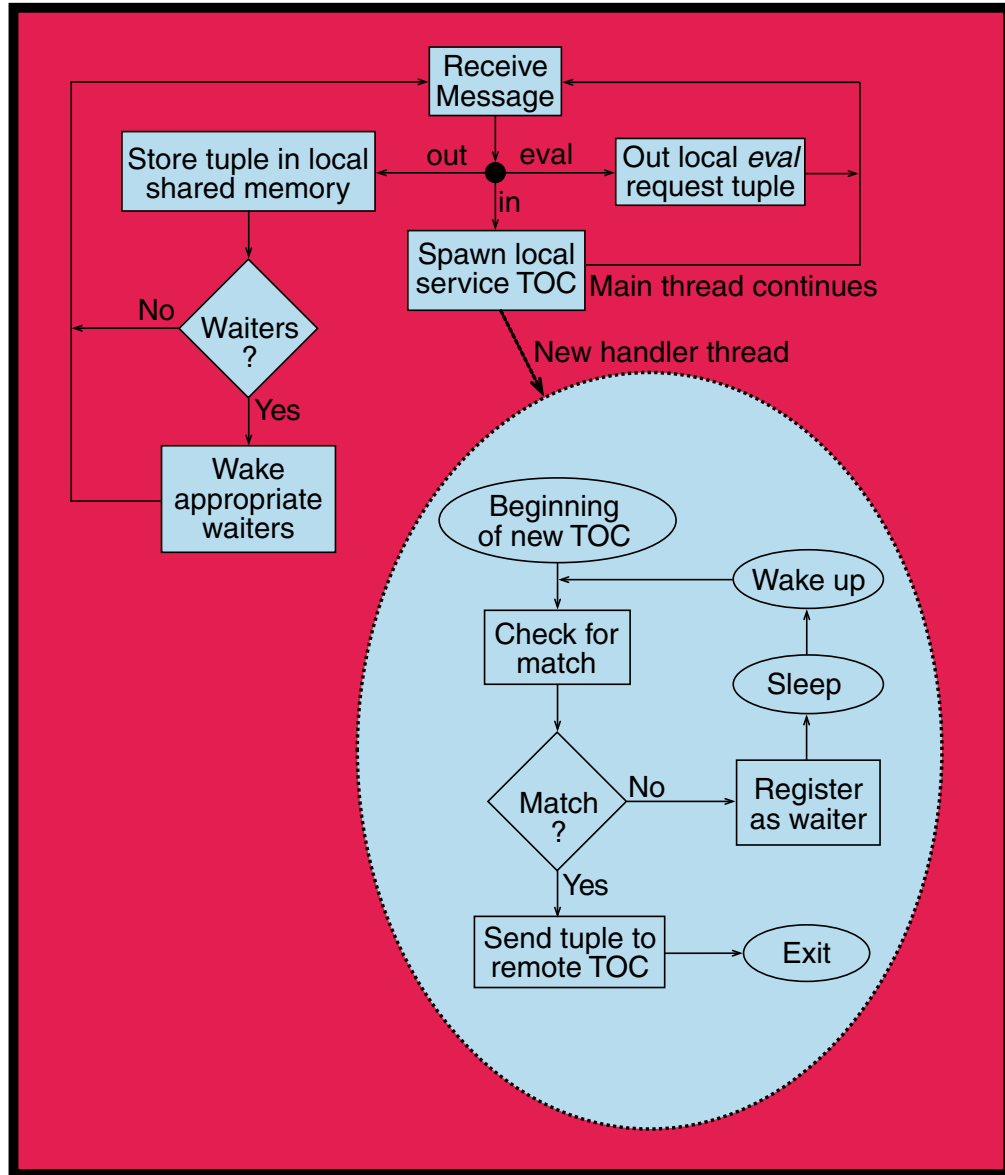
# System Design I

## Hierarchical Linda System Threads of Control

### Eval Server



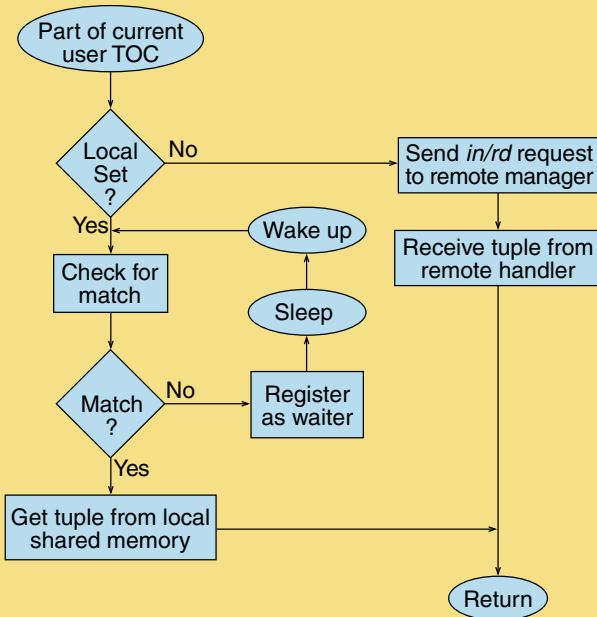
### Proxy Manager



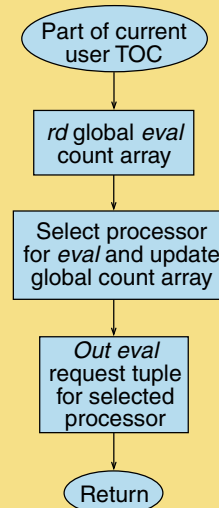
# System Design II

## Linda Code Segments Embedded in User TOCs

*in*/*rd* Processing



*eval* Processing



*out* Processing

